

Are negative automatic thoughts associated with ADHD in Adulthood?

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Abstract:

Recent randomized controlled trials indicate that cognitive-behavioral therapy (CBT) for adults with attention-deficit/hyperactivity disorder (ADHD) is an efficacious treatment. Although treatments for adults with ADHD target negative automatic thoughts, there is a lack of empirical evidence demonstrating that such cognitions are associated with ADHD. The goal of this study was to assess the relationship between ADHD and negative automatic thoughts typically associated with depression in a group of adults diagnosed with ADHD (n = 81). Across the sample, self, collateral, and clinician ratings of inattentive ADHD symptom severity, but not hyperactive-impulsive symptom severity, were significantly associated with negative automatic thoughts after considering the role of current depressive symptom severity. Subsequent categorical analyses were conducted by subdividing the ADHD sample into those with (n = 34) and without (n = 47) a comorbid depression diagnosis, and adding a control group (n = 43). Analyses indicated that (a) the ADHD group with comorbid depression reported significantly more negative automatic thoughts than both controls and the ADHD group without comorbid depression, and (b) the ADHD group without comorbid depression reported significantly more negative automatic thoughts than controls. These findings provide an empirical basis for adult ADHD CBT to target negative automatic thoughts, which share a relationship with ADHD even after accounting for the confounding role of depression. Modification of negative automatic thoughts may be a mechanism of change in adult ADHD CBT and should be considered in future research.

Keywords: attention-deficit/hyperactivity disorder | cognitive-behavioral therapy | negative automatic thoughts | psychology | ADHD

Article:

Attention-deficit/hyperactivity disorder (ADHD) is a developmental disorder characterized by symptoms of inattention, hyperactivity, and impulsivity (American Psychiatric Association 2000). ADHD typically persists into adulthood (Barkley et al. 2008) and occurs in approximately 4 % of adults in the U.S. (Kessler et al. 2006). Though stimulant medication remains the first line of treatment, medicated adults with ADHD continue to demonstrate impairment at work and social settings (Safren et al. 2010a, b). In addition, 20–50 % are non-responsive to medication, and among those who are responsive, symptom reduction of 50 % or less is common (Wender 1998; Wilens et al. 1998; Wilens et al. 2002).

Cognitive-behavioral therapy (CBT) for ADHD in adulthood has garnered increasing empirical interest and support (see Knouse and Safren 2010, for a review). A core component of CBT for adults with ADHD involves cognitive restructuring of automatic thoughts that reflect underlying cognitive structures or core beliefs (Ramsay and Rostain 2008). These types of thoughts refer to brief evaluative thoughts that are not the result of deliberation, but rather are automatized and negatively valenced (Beck 1995). Beck's cognitive therapy has been adapted to address the development of maladaptive thinking patterns in adults with ADHD (McDermott 2000; Ramsay and Rostain 2008; Safren et al. 2004). In these adaptations, the chronic developmental course of ADHD and difficulty functioning in various domains into adulthood results in the development of negative core beliefs likely to be persistent over time, leading to continued maladaptive behavior and impairment. For example, Safren et al. (2004) propose a model in which the core neuropsychiatric deficits that underlie ADHD lead to a history of failure and chronic underachievement. This history of failure engenders the development of dysfunctional thoughts and beliefs, which in turn lead to negative emotional states, contributing to maladaptive compensatory strategies (e.g., avoidance and procrastination). This is consistent with longitudinal studies that demonstrate chronic difficulties for ADHD individuals in multiple domains, including academic, social, occupational, and relational settings (see Barkley et al. 2008, for a review).

Although models (e.g., Safren et al. 2004) have adapted cognitive therapy for ADHD in adulthood and CBT emphasizing cognitive restructuring of negative automatic thoughts is efficacious for ADHD (e.g., Safren et al. 2010a, b; Solanto et al. 2010), little research to date has assessed the relationship between ADHD and maladaptive automatic thoughts. One recent study demonstrated that college students diagnosed with ADHD experience significantly higher ratings on intrusive and worrisome thoughts (Abramovitch and Schweiger 2009), though no studies have considered negative automatic thoughts and the role of comorbid diagnoses. Given that depression is commonly comorbid with ADHD (Barkley 2006) and is associated with negative automatic thought patterns (Beck 1967), the relationship between ADHD and comorbid depression when considering negative automatic thoughts is particularly relevant.

The goal of this study was to assess the relationship between ADHD and negative automatic thoughts in an archival data set of adults diagnosed with ADHD. We hypothesized that inattentive and hyperactive-impulsive ADHD symptoms would be positively associated with negative automatic thoughts, even after considering current depressive symptoms. Categorical analyses were also conducted in which the ADHD sample was stratified into those with and without a comorbid depression diagnosis. In addition, a non-clinical control group was added. We hypothesized that (a) adults with ADHD and a comorbid depressive disorder would report significantly more negative automatic thoughts than adults with ADHD without a comorbid depressive disorder and controls, and (b) adults with ADHD without a comorbid depressive disorder would report significantly more negative automatic thoughts than controls.

Method

Participants

Clinical Sample

Archival clinical data were collected from the charts of a total of 81 adults who had completed an outpatient evaluation at an ADHD clinic and were diagnosed with ADHD. These participants received a full psychological evaluation assessing ADHD and other Axis I disorders following DSM-IV criteria. Assessments included a modified adult version of the ADHD module in the Diagnostic Interview Schedule for Children (DISC; Shaffer et al. 2000), self and collateral reports of current and past ADHD symptoms (ADHD Rating Scale-IV [ADHDRS]; DuPaul et al. 1998), standardized self-report of current ADHD symptoms (Conners' Adult ADHD Rating Scale [CAARS]; Conners et al. 1999), clinician-administered Structured Clinical Interview for DSM Disorders (SCID; First et al. 1997) for Axis I disorders, and the Beck Depression Inventory (BDI; Beck et al. 1961). All of those meeting criteria for ADHD, including Not Otherwise Specified and In Partial Remission, were included. All assessments were conducted by advanced doctoral students in clinical psychology under the supervision of a licensed clinical psychologist. Table 1 summarizes the clinical sample characteristics. Because this was an archival data analyses, limited demographic variables were collected.

Table 1

Demographic characteristics of ADHD sample and control sample

ADHD (<i>n</i> = 81)				Controls (<i>n</i> = 43)				
<i>M</i>	<i>SD</i>	<i>N</i>	(%)	<i>M</i>	<i>SD</i>	<i>N</i>	(%)	<i>p</i> value
Age	27.22	9.89			19.87	3.74		<.001
Sex								.37
Male			35	(43)			15	(31)
Female			46	(57)			28	(65)
CAARS DSM-IV inattentive (T score)	83.95	12.23			52.01	11.0		<.001
CAARS DSM-IV hyperactive-impulsive (T score)	66.23	12.55			45.38	8.43		<.001
CAARS ADHD index (T score)	68.47	10.68			46.26	8.24		<.001
ADHDRS inattentive symptom severity	19.56	5.22			7.38	4.84		<.001
ADHDRS hyperactive-impulsive symptom severity	15.40	5.75			7.92	5.28		<.001
BDI total score	15.67	10.34			9.52	8.28		<.001
<i>DSM-IV</i> diagnoses								
ADHD								
Predominantly inattentive			16	(20)				

ADHD (<i>n</i> = 81)				Controls (<i>n</i> = 43)				
<i>M</i>	<i>SD</i>	<i>N</i>	(%)	<i>M</i>	<i>SD</i>	<i>N</i>	(%)	<i>p</i> value
Predominantly hyperactive-impulsive			0	(0)				
Combined			40	(49)				
In partial remission			5	(6)				
Not otherwise specified			20	(25)				
Depressive disorder			34	(42)				
Anxiety disorder			29	(36)				
Substance use disorder			6	(7)				
Eating disorder			1	(1)				
Adjustment disorder			2	(3)				

All group comparisons analyses involved Chi square analysis (gender comparison) or ANOVA (all other comparisons). All *F*'s ranged from 18.59 to 204.47, $\chi^2(1) = 0.81, p = .37$. BDI = Beck depression inventory, *DSM-IV Diagnostic and statistical manual of mental disorders* (4th edition), *CAARS* Conners adult ADHD rating scale, *ADHDRS* ADHD rating scale symptom severity ratings are based on self-report. Of the 81 participants diagnosed with ADHD, 29 (36 %) did not meet criteria for a comorbid disorder. Control group members were not administered the Structured Clinical Interview for *DSM-IV* Disorders

Control Sample

Data were also collected from a non-clinical control group (*n* = 48) of undergraduate students enrolled in a large, public, Southeastern university in the same city as the clinic where ADHD participants were recruited. Data were collected to permit secondary categorical analyses with a control group. This sample completed a demographic information form, self-reported *ADHDRS*, *CAARS*, and *BDI*, and a measure of negative automatic thoughts. Control group participants that

yielded T scores ≥ 65 on the CAARS ADHD Index subscale were removed ($n = 5$).

Characteristics for this final control sample ($n = 43$) are presented in Table 1. According to Table 1, the control group endorsed significantly less severe depressive and ADHD symptoms than the ADHD group.

Measures

Diagnostic Interviews

A modified version of the ADHD module from the DISC (Shaffer et al. 2000) was administered to adults in the clinical sample as part of the ADHD evaluation. The DISC has well-established reliability for the diagnosis of ADHD in children (Shaffer et al. 2000). The module was modified to assess full DSM-IV ADHD diagnostic criteria in adults. The modified interview yields clinician-assessed symptom counts for inattentive and hyperactive-impulsive ADHD symptoms and assesses full DSM-IV diagnostic criteria for ADHD. The extent of the modification of this interview involved revised wording of an item to match developmental appropriateness. Modification of this item for adults is noted in the DSM-IV and is similar to other interviews that assess ADHD in adulthood (Epstein et al. 2000). Specifically, this modification involved the hyperactive-impulsive symptom pertaining to excessively running around or climbing. Participants were asked if they often “feel restless, as if you wanted to kick your feet or get up and move around” in situations when it was not appropriate. This interview was administered only to the clinical sample. Similarly, the clinician-administered SCID (First et al. 1997) was administered to the clinical sample only to diagnosis Axis I comorbidities.

ADHD Measures

The CAARS (Conners et al. 1999) was administered to both groups. This 66-item self-report measure of current ADHD behaviors has considerable normative data. Response options are on a four-point scale. The CAARS has demonstrated adequate reliability and validity (Erhardt et al. 1999). Standardized ratings for DSM ADHD symptoms and an ADHD Index subscale were included for the current study. The latter subscale is useful for differentiating ADHD individuals from non-ADHD individuals. ADHD symptom severity for the past 6 months was also assessed by the ADHDRS (DuPaul et al. 1998) modified for adults. This modification includes response choices to assess current and childhood symptoms. The ADHDRS contains 18 items corresponding to the nine inattention and nine hyperactive-impulsive symptoms from the DSM-IV. Items are rated on a four-point scale. Current symptom severity scores for both inattentive and hyperactivity-impulsivity ADHD symptoms were considered in this study. Coefficient alpha's for the subscales and total scale range .86–.92 and test–retest reliability over 4 weeks is .78–.86 (DuPaul et al. 1998). The self-report version of the ADHDRS was administered to both

the ADHD sample and controls. Collateral reporter versions of the ADHDRS were collected from the clinical sample only. Self-reported ADHDRS scores, instead of CAARS scores, were used in the dimensional analysis below to reduce the number of analyses. Given that the ADHD DSM symptom scores for both scales are derived from the same 18 core symptoms as defined by the DSM-IV, both scores would be largely redundant.

Depressive Symptoms

The BDI (Beck et al. 1961) is a 21-item questionnaire that assesses depressive symptoms in adults, such as feelings of failure, disappointment in self, and thoughts of suicide. The respondent rates on a four-point scale which statement from a group of four statements best describes him or her in the past 2 weeks. Higher scores are representative of more severe depressive symptoms (e.g., total scores ≤ 9 = normal range, 10–18 = mild to moderate depression, 19–29 = moderate to severe depression, ≥ 30 = severe depression). The BDI is widely used in research and clinical practice as a measure of depressive symptomatology with very good reliability and validity (Beck et al. 1988).

Negative Automatic Thoughts

The Automatic Thought Questionnaire (ATQ; Hollon and Kendall 1980) is a 30-item questionnaire designed to measure the occurrence of automatic negative thoughts associated with depression. Example items include “I’ve let people down,” “I’m worthless,” and “I hate myself.” Respondents rate how frequently a thought occurred over the last week on a scale ranging from 1 (not at all) to 5 (all the time). Higher scores are indicative of more frequent and severe negative automatic thoughts. The ATQ has very good reliability (e.g., coefficient alpha = .96) and distinguishes between depressed and non-depressed groups (Hollon and Kendall 1980).

Procedure

Clinical Sample

An archival chart review was conducted to determine appropriateness for inclusion. Criteria for inclusion were that the client (a) was over the age of 18 at the time of the evaluation, (b) completed the ATQ as part of the evaluation, (c) met criteria for ADHD, and (d) had completed the assessment and received feedback about his or her diagnosis. Chart reviews were conducted for evaluations from 2008 to 2010. Evaluation data were de-identified in accordance with HIPAA and IRB regulations prior to data entry. Assessment data from charts were entered into a

database and a unique identification number was assigned to each person. Participants who met criteria for bipolar disorder ($n = 2$) were excluded. A total of 81 clients met inclusion criteria.

Control Sample

The control group was comprised of 48 undergraduate students participating for research credit. After removing 5 participants who yielded T scores ≥ 65 on the CAARS ADHD Index subscale, the final sample was composed of 43 individuals. Students were asked to complete many of the same self-report measures routinely administered as part of the established clinical ADHD evaluation, including the ADHDRS self-report version, CAARS, ATQ, and BDI. In addition to these forms, students completed consent, demographic, and study debriefing forms. All data collection procedures received full IRB approval.

Results

Dimensional Analyses

To test the hypothesis that inattentive and hyperactive-impulsive ADHD symptom severity would be positively associated with negative automatic thoughts in an ADHD sample, bivariate correlation coefficients were calculated. Table 2 lists the correlation coefficients assessing the bivariate relationships between inattentive and hyperactive-impulsive ADHD symptom severity (self-reported, collateral, and clinician ratings), ATQ, and BDI ratings among the clinical sample. Table 2 indicates that hyperactive-impulsive ADHD symptom severity scores did not have any statistically significant relationships with ATQ scores, though inattentive ADHD symptom severity assessed via self-report, collateral, and clinician ratings were all positively correlated with ATQ scores (all p 's $< .05$). However, BDI ratings were also highly correlated with inattentive ADHD symptom severity (self-reported $r = .48$, $p < .001$, collateral $r = .33$, $p = .003$, clinician rating $r = .26$, $p = .02$) and ATQ ratings ($r = .80$, $p < .001$). To address whether the relationship between inattentive symptom severity and ATQ ratings was an artifact of higher BDI ratings, regression analyses were conducted.

Table 2

Bivariate correlations between ADHD symptom severity, negative automatic thoughts, and depressive symptom severity in a sample of adults diagnosed with ADHD (n = 81)

	IA Self	HI Self	IA Collateral	HI Collateral	IA Clinician	HI Clinician	ATQ	BDI
IA self	–							
HI self	.50**	–						
IA collateral	.53**	.23*	–					
HI collateral	.15	.57**	.46**	–				
IA clinician	.63**	.26**	.32**	-.05	–			
HI clinician	.20	.66**	.13	.54**	.17	–		
ATQ	.57**	.14	.41**	.01	.34**	-.14	–	
BDI	.48**	.20	.33**	.10	.26*	.003	.80**	–

Collateral ratings based on $n = 80$ due to one missing collateral reporter *IA* inattentive, *HI* hyperactive-impulsive, *ATQ* Automatic thought questionnaire, *BDI* Beck depression inventory

* $p < .05$; ** $p < .01$

In three separate hierarchical regressions, gender and age were entered in the first step, BDI ratings were entered in the second step, and inattentive ADHD symptom severity scores according to one of three raters (i.e., self, collateral, or clinician) were entered in the third step as predictors of ATQ scores. Across all three separate regression models, gender and age were not significant predictors of ATQ scores, while BDI scores accounted for the majority of the variance ($\beta = .80$, $\Delta R^2 = .64$, $p < .001$ in each regression model). When inattentive symptom severity scores were entered into these regressions separately, self-reported ($\beta = .27$, $\Delta R^2 = .05$, $p = .001$), collateral ($\beta = .17$, $\Delta R^2 = .03$, $p = .02$), and clinician ratings ($\beta = .16$, $\Delta R^2 = .02$, $p = .02$) were significant ATQ score predictors.

Categorical Analyses

To assess if negative automatic thoughts were higher in adults with ADHD than controls, we compared adults from the ADHD clinical sample to the control group. To assess the impact of a comorbid depression diagnosis in the ADHD group (based on findings from the SCID), the sample was divided into ADHD diagnosis without a comorbid depressive disorder (ADHD) ($n = 47$), ADHD diagnosis with a comorbid depressive disorder (ADHD + Depression) ($n = 34$), and controls ($n = 43$). ATQ scores continued to be the dependent variable in these analyses.

As would be expected, the ADHD + Depression group yielded statistically significantly higher BDI scores ($M = 21.21$, $SD = 9.98$) than the ADHD group ($M = 11.66$, $SD = 8.68$) and controls ($M = 8.05$, $SD = 7.16$) (p 's $< .001$), though the ADHD and control groups did not differ ($p = .12$). An equal proportion of females was present in each group (53 % ADHD, 62 % ADHD + Depression, and 65 % controls), $\chi^2(2) = 1.41$, $p = .49$. However, the control group was significantly younger ($M = 19.87$, $SD = 3.74$) than both the ADHD ($M = 27.96$, $SD = 10.63$) and ADHD + Depression groups ($M = 26.21$, $SD = 8.80$), $F(2, 121) = 11.43$, $p < .001$. Therefore, age was covaried in a one-way ANCOVA (see Fig. 1). This analysis indicated significant between-group differences on ATQ scores (ADHD group: $M = 66.28$, $SD = 28.16$, adjusted $M = 66.39$, adjusted $SD = 27.31$, ADHD + Depression: $M = 89.26$, $SD = 29.58$, adjusted $M = 89.32$, adjusted $SD = 26.64$, Control group: $M = 51.23$, $SD = 21.28$, adjusted $M = 51.07$, adjusted $SD = 28.04$), $F(2, 120) = 18.45$, $p < .001$. Tukey post hoc multiple comparisons indicated that the ADHD + Depression group scored significantly higher than the ADHD group ($p < .001$, Cohen's $d = 0.80$) and control group ($p < .001$, Cohen's $d = 1.48$), and the ADHD group scored significantly higher than the control group on ATQ scores ($p = .01$, Cohen's $d = 0.60$).

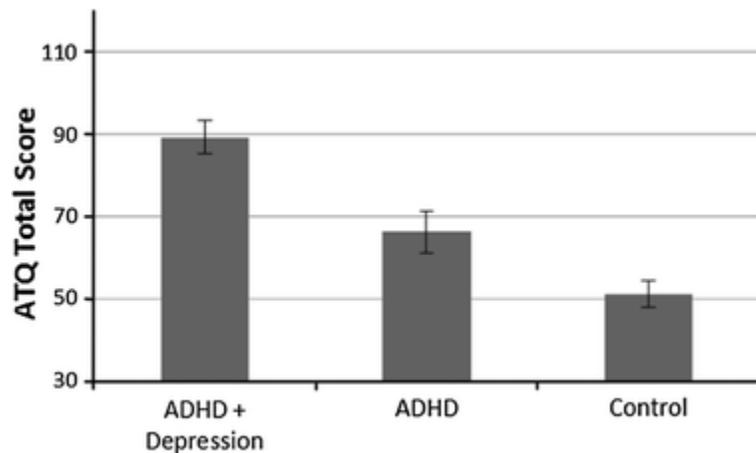


Fig. 1

Group differences in negative automatic thoughts across groups (error bars represent standard error). The ADHD + Depression group scored significantly higher than the ADHD ($p < .001$) and Control groups ($p < .001$), while the ADHD group scored significantly higher than the Control group ($p = .01$). The distribution of ADHD subtypes across both ADHD groups was similar between the ADHD + Depression group and the ADHD group without Depression (i.e., 17 (50 %) and 23 (49 %) met criteria for ADHD Combined Type, 6 (18 %) and 10 (21 %) for ADHD Inattentive Type, 9 (26 %) and 11 (23 %) for ADHD NOS, and 2 (6 %) and 3 (6 %) for ADHD In Partial Remission in the ADHD + Depression and ADHD groups, respectively)

Discussion

The current study assessed the relationship between ADHD and negative automatic thoughts. Dimensional analysis demonstrated that inattentive ADHD symptoms were associated with negative automatic thoughts across three different ADHD symptom reporting sources (i.e., self, collateral, and clinician ratings) in a sample of adults diagnosed with ADHD. These findings remained significant for all reporting sources after taking current depressive symptoms into account. In contrast, hyperactive-impulsive ADHD symptoms were not associated with negative automatic thoughts. This is the first study to demonstrate a relationship between ADHD symptoms and negative automatic thought patterns while considering current depressive symptoms. In particular, this is the first study to demonstrate that this relationship is driven by inattentive ADHD symptoms when assessed across three separate reporting sources. Though the variance accounted for by inattentive symptoms in predicting negative automatic thoughts typically associated with depression was relatively small across multiple regression models, this was above and beyond current depression ratings. The specificity of these results to inattentive

symptom severity is consistent with previous findings that inattentive symptoms contribute more to depressive symptoms than hyperactive-impulsive symptoms (Rabiner et al. 2008).

Though there was no relationship between hyperactive-impulsive ADHD symptoms and negative automatic thoughts, future studies should consider the relationship between these symptoms and other maladaptive thinking patterns. For instance, although these symptoms were not associated with negative thought patterns, they may be associated with overly positive cognitions (e.g., “I can finish all of my work in one night”). This would be consistent with findings that hyperactive-impulsive symptoms are more strongly related to positive illusory self-perceptions than inattentive symptoms (Owens and Hoza 2003). Although negative automatic thoughts assessed in this study are not specific to ADHD, overly positive thinking patterns may be.

Categorical analysis indicated that adults diagnosed with ADHD and a comorbid depressive disorder endorsed a significantly higher severity of negative automatic thoughts than adults diagnosed with ADHD without a comorbid depressive disorder. Further, the latter group endorsed a significantly higher severity of negative automatic thoughts than controls. Effect size estimates (Cohen 1988) were large when the ADHD group with depression was compared against the ADHD group without depression and the control group, and medium when the ADHD group without depression was compared against the control group. These findings indicate that even among adults diagnosed with ADHD without a comorbid depression diagnosis, there is a relationship between ADHD and negative automatic thoughts.

These findings have important clinical and research implications. Modification of negative automatic thoughts may be a mechanism of change in adult ADHD CBT. That is, a general principle in cognitive therapy is that targeted cognitive processes mediate positive treatment outcome. In treating depression with CBT, this principle is generally supported (Garratt et al. 2007; Ingram et al. 2007). Consistent with the underlying rationale that maladaptive cognitions are a mechanism of change in cognitive therapy, Ramsay (2010) proposed that cognitive modification may play an important role in adult ADHD CBT. For example, thoughts that magnify negative views of oneself or incompetence based on past failures may be modified via cognitive restructuring. Targeting such automatic thoughts presumes that they are elevated in ADHD. The findings in the current study demonstrate that such cognitions are elevated in ADHD and are not solely a function of comorbid depression. Future studies addressing mechanisms of change should assess the extent to which negative automatic thoughts are modified over the course of treatment and their relation to changes in ADHD symptoms. In patients with comorbid ADHD and depression, changes in negative automatic thoughts over the course of treatment relative to changes in ADHD and depressive symptoms should be considered as well. Regarding developmental models that propose ADHD symptoms lead to negative automatic thought patterns into adulthood (McDermott 2000; Ramsay and Rostain 2008; Safren et al. 2004), the current findings provide support, though longitudinal designs are needed to more thoroughly assess such models.

Although the current findings are novel and promising, they should be tempered by limitations. First, the control group was composed of undergraduate students. Their inclusion could have impacted the group analysis. For example, it is possible that the control group yielded artificially lower negative automatic thought scores in comparison to a non-student control group, which in turn could have increased the likelihood of Type I error. However, the control group mean for ATQ scores in the current study was comparable with control group ATQ scores from previous studies. For instance, in a series of recent studies comparing a psychiatric sample against a non-clinical sample, ATQ total scores for control groups ranged from 32.33 to 49.63 (Dozois 2007; Ingram et al. 2007; Lau et al. 2007; Lex et al. 2008; Morillo et al. 2007; Sigmon et al. 2007). In contrast, the control group ATQ mean for the current study was 51.23, indicating that the control group in this study constituted a comparison group that likely did not result in artificially lower control group ATQ scores that would inflate group differences.

Second and related to this limitation, the control group did not receive a full psychological evaluation as the two ADHD groups did and was younger. Though age was covaried, future research should consider the source of the control group and conduct thorough evaluations in light of these findings. For instance, other factors besides age (e.g., financial stress) may vary between samples composed of college students and those from the community. Third, because this was an archival data analysis, only limited demographic variables were collected. Future research in this area would benefit from the incorporation of additional demographic variables (e.g., ethnicity and SES) to overcome this limitation. Another limitation of the current study is that ADHD subtypes were not considered in relation to negative automatic thoughts in the categorical analysis. Studies with larger samples to ensure greater statistical power should address this issue. However, based on our dimensional findings, ADHD subtypes characterized by inattention should be more likely to endorse patterns of negative automatic thinking.

Future studies should consider alternative measures and methods of assessing automatic thoughts patterns in ADHD. In addition to questionnaires, cognitive assessment approaches of ongoing thinking in a controlled environment such as the Articulated Thoughts in Simulated Situations paradigm may be beneficial (Zanov and Davison 2009). Future studies should also expand beyond the content of thoughts in ADHD to examine the role of cognitive processes. For instance, rumination, which is different from negative automatic thoughts in that rumination involves the process of thinking perseveratively about one's feelings and problems as opposed to specific thought content, is associated with a variety of psychopathologies (Nolen-Hoeksema et al. 2008). Relatedly, cognitive inflexibility and difficulty regulating one's attention is associated with rumination. Given that ADHD is characterized by deficits in executive functioning (e.g., Boonstra et al. 2005), which includes various component functions such as set shifting, working memory, and response inhibition, future research should consider how these executive functioning deficits in ADHD are associated with rumination. Indeed, an alternative explanation for the relationship between ADHD, particularly inattention symptoms, and negative automatic thoughts is that executive functioning deficits linked to inattention in ADHD result in

impairment that may potentiate maladaptive thinking patterns. Consistent with this interpretation, inattention within adults with ADHD is associated with poorer executive functioning and poorer adaptive functioning (Stavro et al. 2007).

Despite these limitations, this was the first study to assess the relationship between negative automatic thoughts and ADHD symptoms in a sample of adults diagnosed with ADHD. A robust relationship between inattentive ADHD symptoms and negative automatic thoughts—but not hyperactive-impulsive symptoms—emerged across multiple reporting sources. This relationship was upheld after the potentially confounding role of current depressive symptoms was considered. Also, group-based analysis indicated that adults diagnosed with ADHD without comorbid depression reported lower levels of negative automatic thoughts than an ADHD group with comorbid depression, but higher levels of negative automatic thoughts than a control group. The current findings strengthen the empirical basis for targeting negative automatic thoughts in adult ADHD CBT. Modification of automatic thoughts should be considered as a potential mechanism of change in future treatment outcome research. Such research should lead to improved understanding of why CBT is efficacious in adults with ADHD.

Conflict of interest

None.

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